

## **Gov. Rounds and SD Science and Technology Authority complete land closing with Homestake**

*Paves the way for the creation of an underground science laboratory at Lead, SD*

PIERRE, S.D. – Gov. Mike Rounds along with Dave Bozied, Chairperson of the South Dakota Science and Technology Authority (Authority) and Patrick Garver, Executive Vice President and General Counsel of Barrick Gold Corporation are pleased to announce the completion of the land transfer agreement of the Homestake Gold Mine in Lead, S.D. to the Authority.

“The transfer culminates a long cooperative effort between Homestake Mining Company, the state and the Authority,” said the governor on the announcement. “It couldn’t have happened without the continued patience and support of the people of South Dakota.”

The Authority will begin moving into the facilities as soon as office renovations are completed.

“By filing the signed documents with the Lawrence County Register of Deeds, we officially complete the land transfer agreement,” said the governor. “I am thankful for the encouragement and support of the Homestake Collaboration, our universities, and the entire scientific community. The transfer provides an opportunity for a new era for science and education in our state.”

The Authority estimates that the budget for the Interim Laboratory, including capital requirements and operating expenses through the year 2012, will be approximately \$32.1 million. The Authority controls, or has access to, approximately \$44 million that could be committed to this purpose. Some of the immediate expenditures include \$800,000 for the closure fund; \$2.5 million in insurance premiums; and \$10 million for the indemnification fund.

# DESIGN AND CONSTRUCTION OF A MODULAR MASSIVE DETECTOR AT THE HOMESTAKE LAB

- Modular Mass – 100 Kilotons
- Modular Shape –Cylinder –50m dia x 50m high
- Depth – 4200 mwe (cosmic ray rate = 0.1Hz)
- Photocathode coverage – 25%
- Initial Detector – 3 modules (300 kilotons)
- Construction time - 5 years for 3 modules
- Cost - ~ \$100 M / module
- Ultimate detector – 10 modules (1 Megaton)



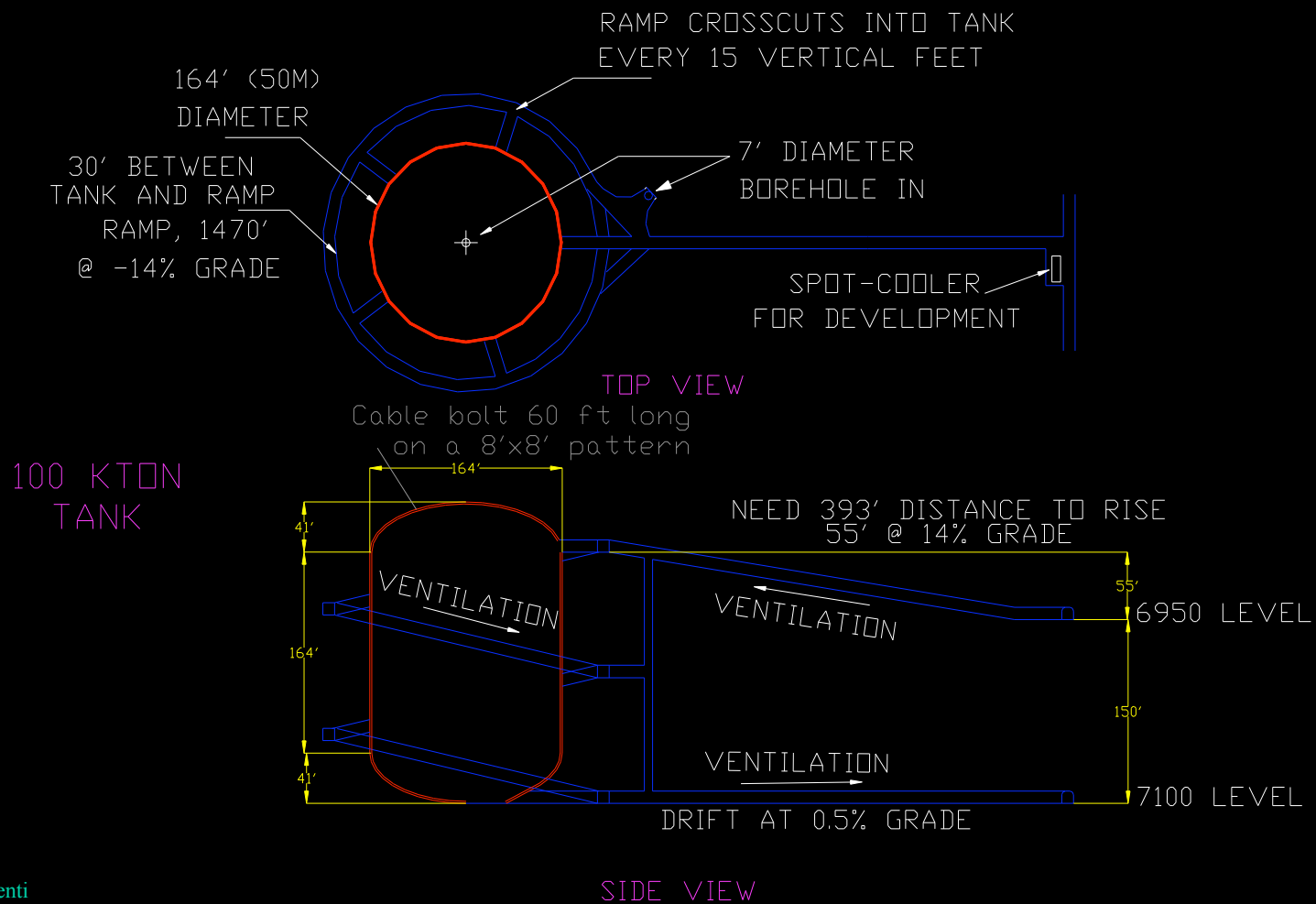
# DETECTOR MODULE DESIGN CHARACTERISTICS

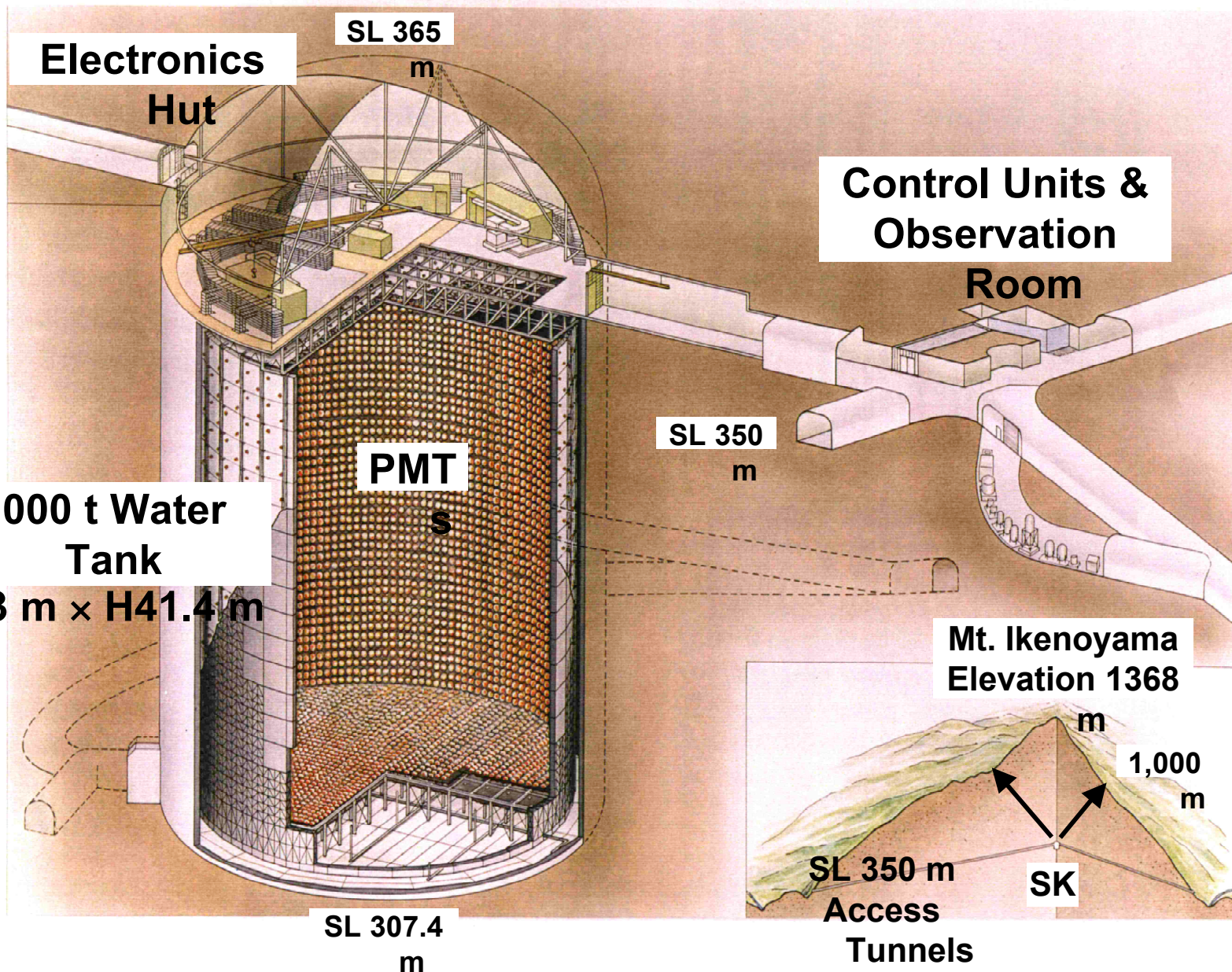
- **Excavation stability studies – O.K.**
- (excavation is very similar to SuperK, ~ 25% larger in each linear dimension)
- **Vertical cylinder with concrete liner and multi-layer water tight plastic liner**
- (SuperKamiokande has a steel tank)
- **Photomultiplier tubes can be inserted and removed without draining water**

# Presentation

- **1) Summarize excavation stability studies**
- **2) Describe excavation procedure**
- **3) Photomultiplier size, spacing & resolution**
- **4) Budget and Timetable**
- **5) Requirements for coming year**

# SINGLE 100 KILOTON MODULE - HOMESTAKE





# **Feasibility Study of a Large Excavation at the Homestake Mine carried out by**

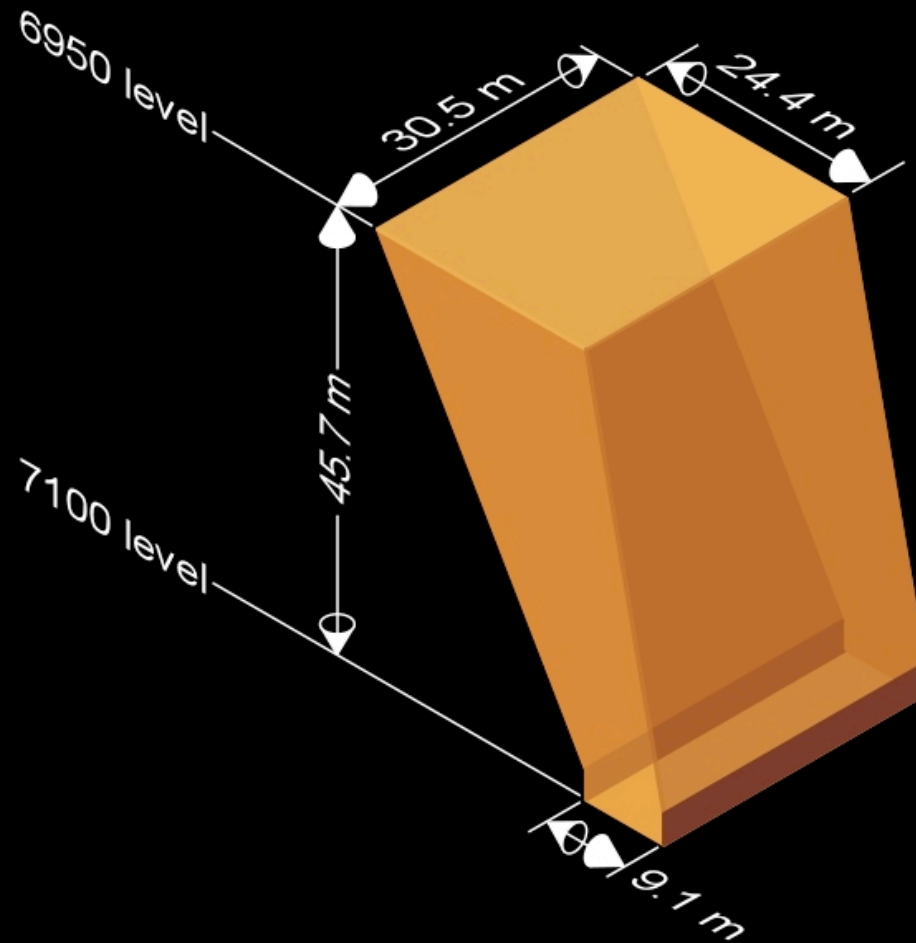
**Doug Tesarik, Jeff Johnson, Karl Zipf**

**Hard Rock Stability Group – Spokane Laboratory of  
NIOSH (formally Bureau of Mines)**

# Methodology

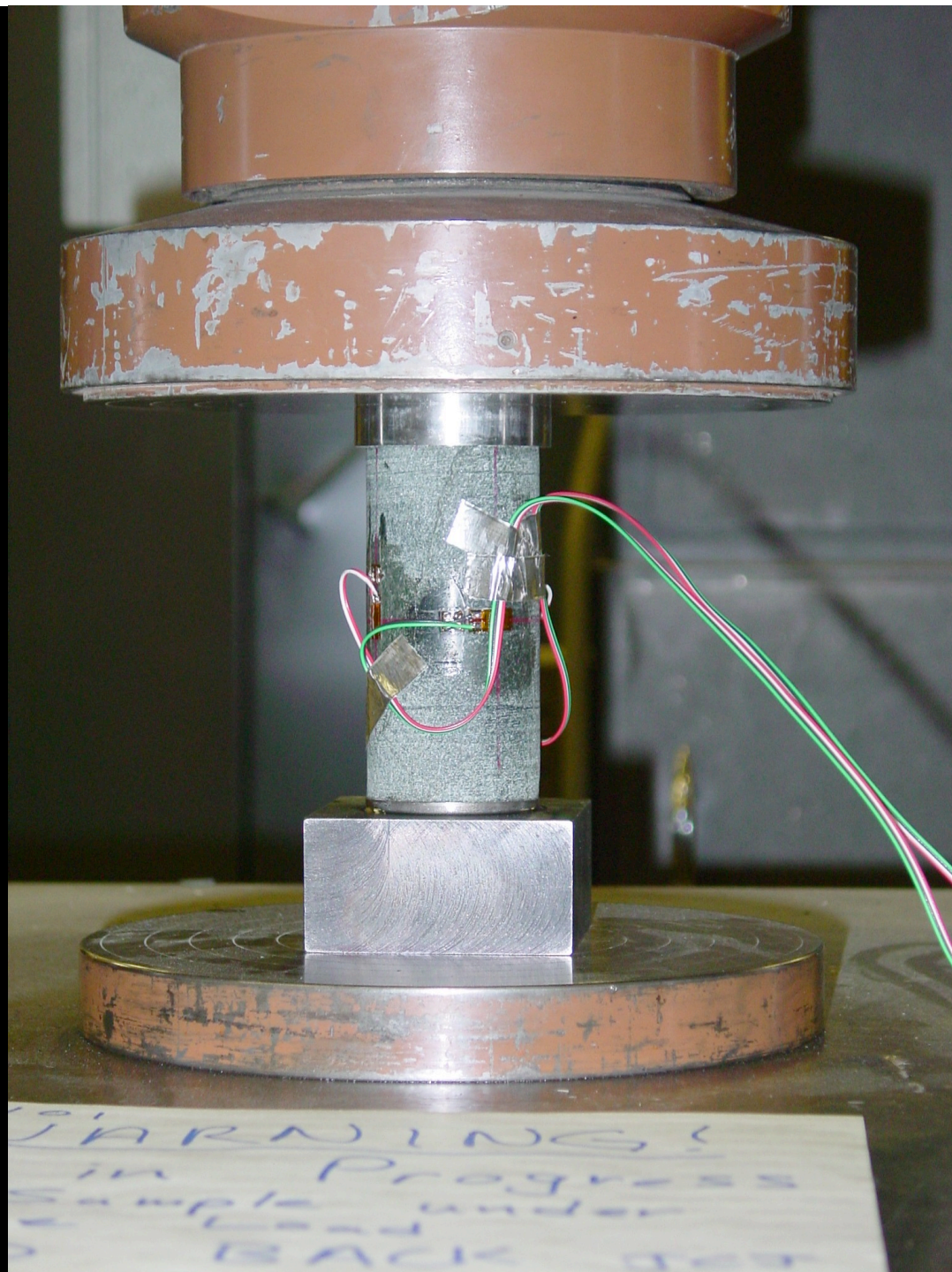
- **Case History**
- **FLAC-3d numeric modeling**
- **Empirical charts from tunneling**

# Homestake Panel 3 – VCR Study

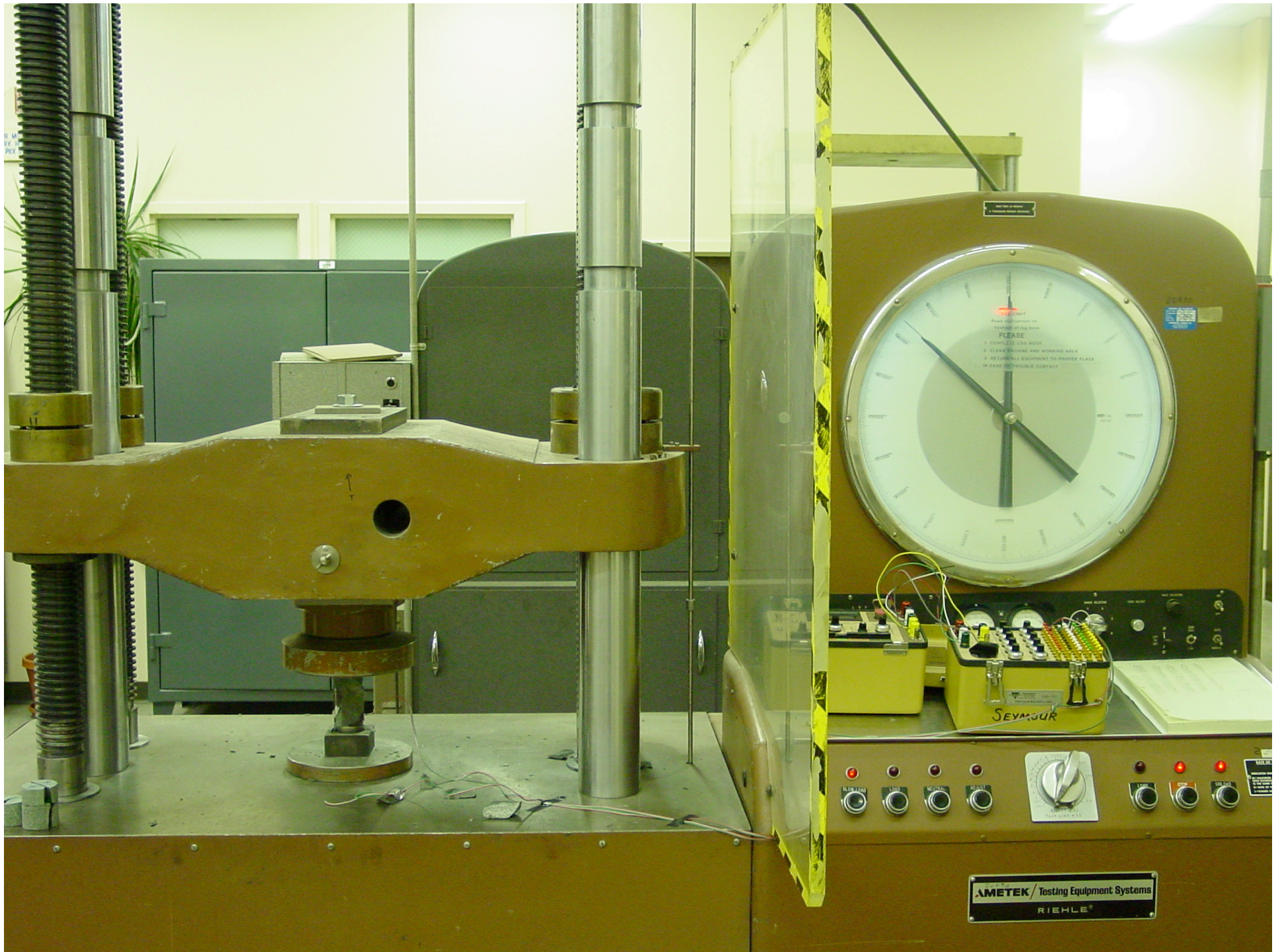


After Pariseau, Duan and Schmuck





WARNING!  
in Progress  
Sample under  
Load  
BACK test



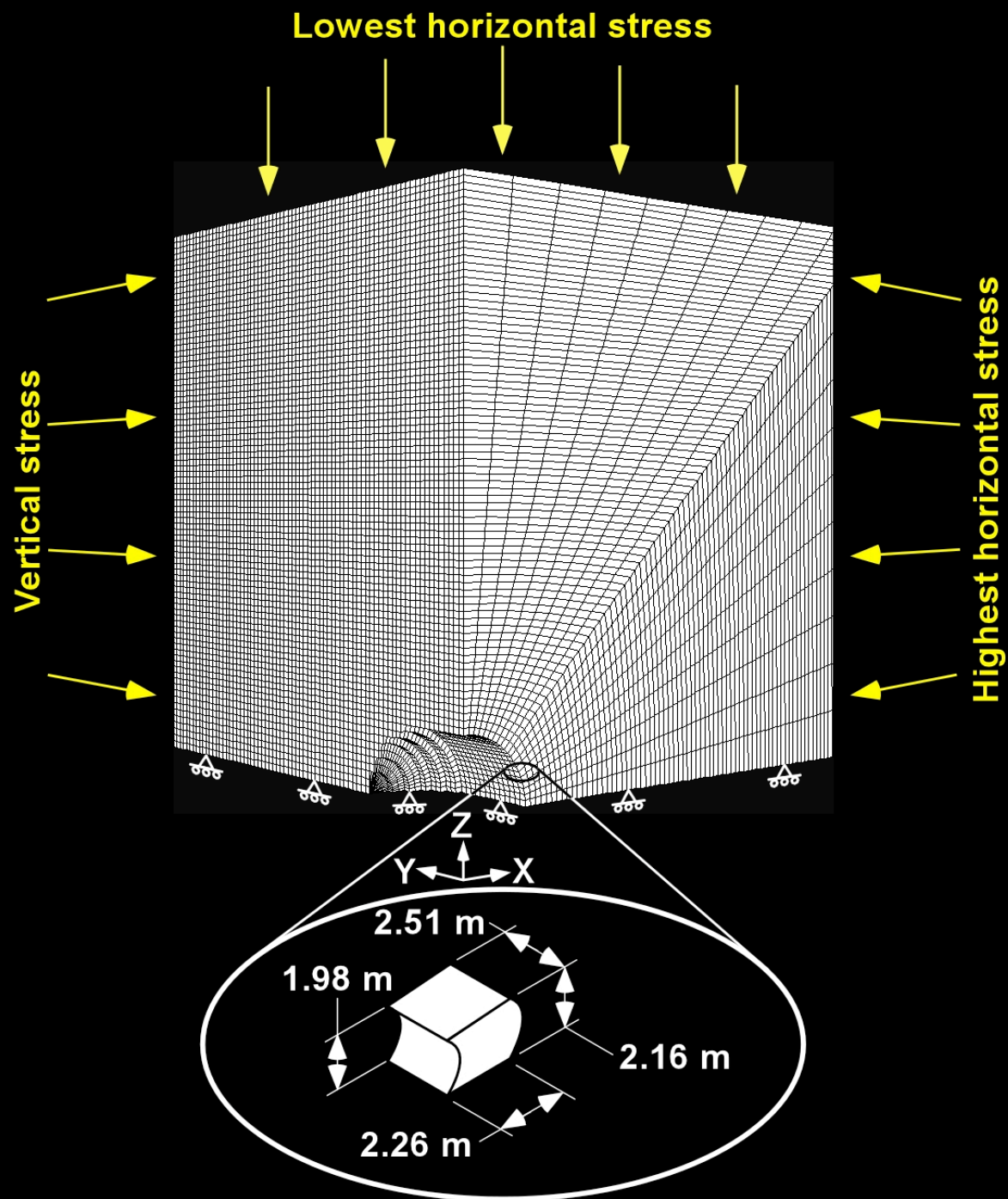


# YATES LABORATORY PROPERTIES

- $E = 14,500,000 \text{ psi}$
- Tensile Strength = 1890 psi
- UCS = 28,800 psi!

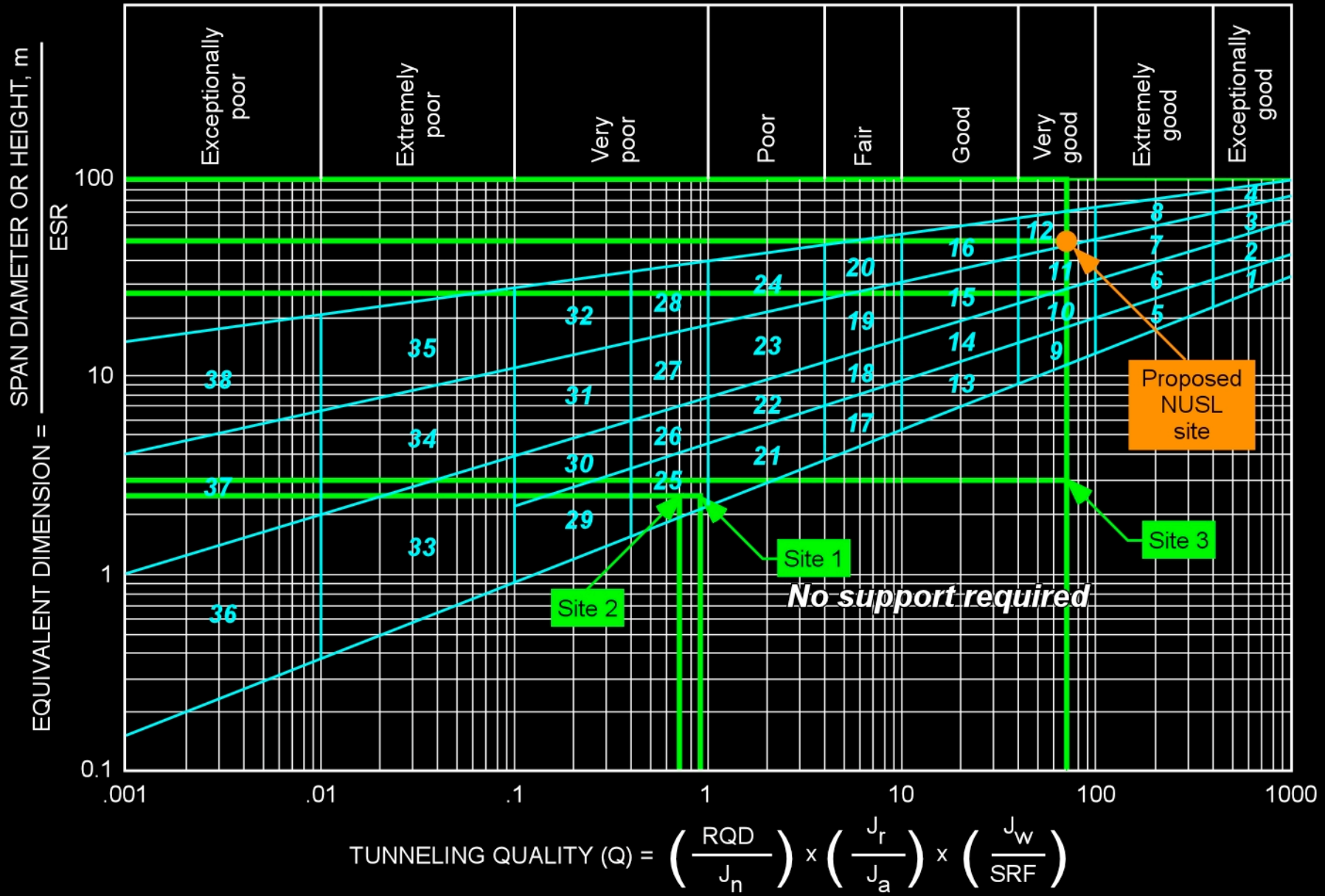
# MATERIAL PROPERTY REDUCTION

- Modulus reduced 25%
- Strengths reduced 50%
- Cohesion = 30 deg.



# EMPIRICAL METHODS

Barton's Tunneling Quality  
Index



# RECOMMENDED ROOF SUPPORT - BARTON

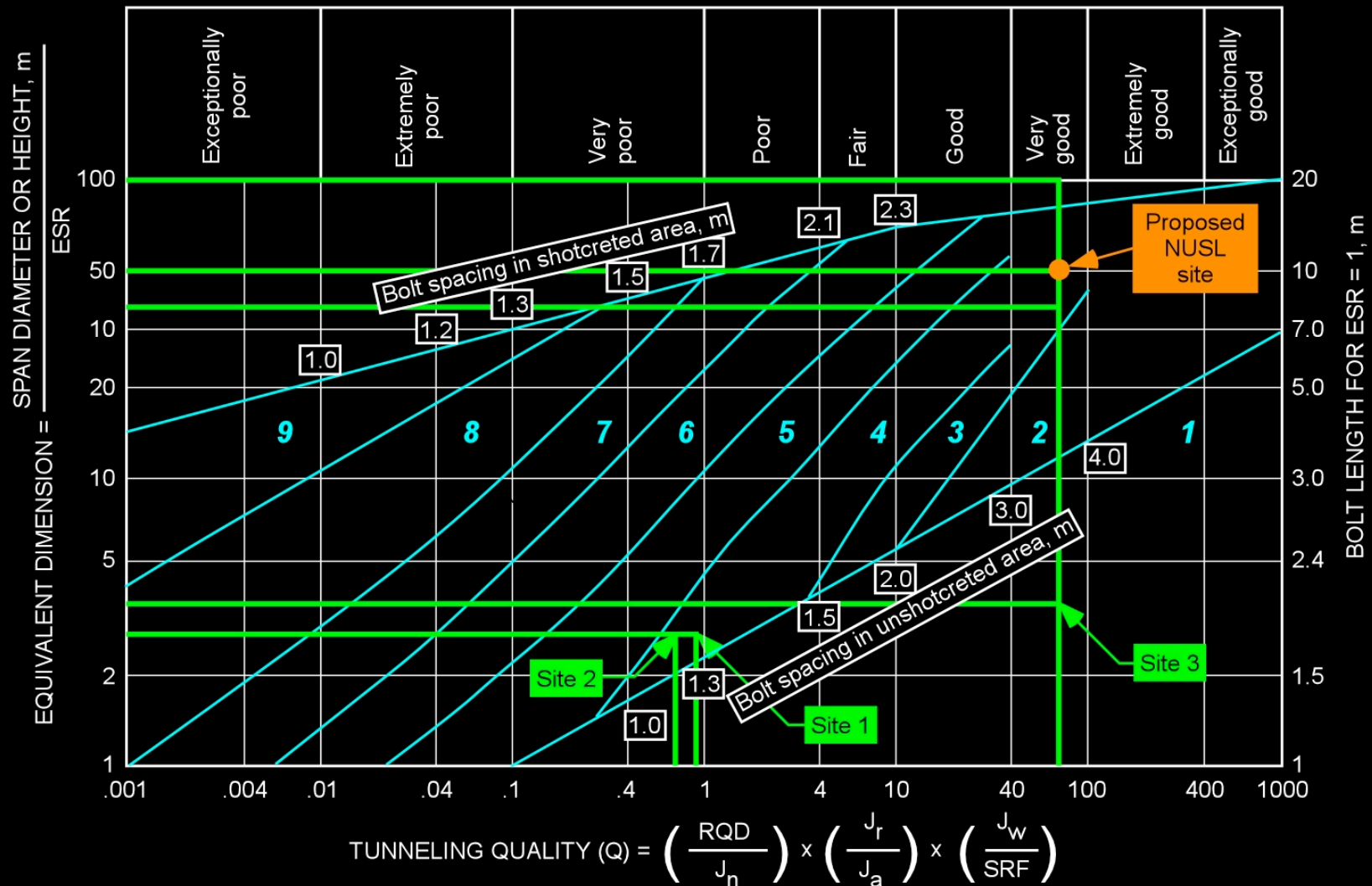
- TENSIONED BOLTS
- 2 – 3-m SPACING

# EMPIRICAL METHODS

GRIMSTAD AND BARTON

# KEY

- 1** Unsupported
- 2** Spot bolting
- 3** Systematic bolting
- 4** Systematic bolting with 40-50 mm unreinforced shotcrete
- 5** Fibre reinforced shotcrete, 50-90 mm and bolting
- 6** Fibre reinforced shotcrete, 90-120 mm, and bolting
- 7** Fibre reinforced shotcrete, 120-150 mm, and bolting
- 8** Fibre reinforced shotcrete, 150-250 mm, with reinforced ribs of shotcrete and bolting
- 9** Cast concrete lining

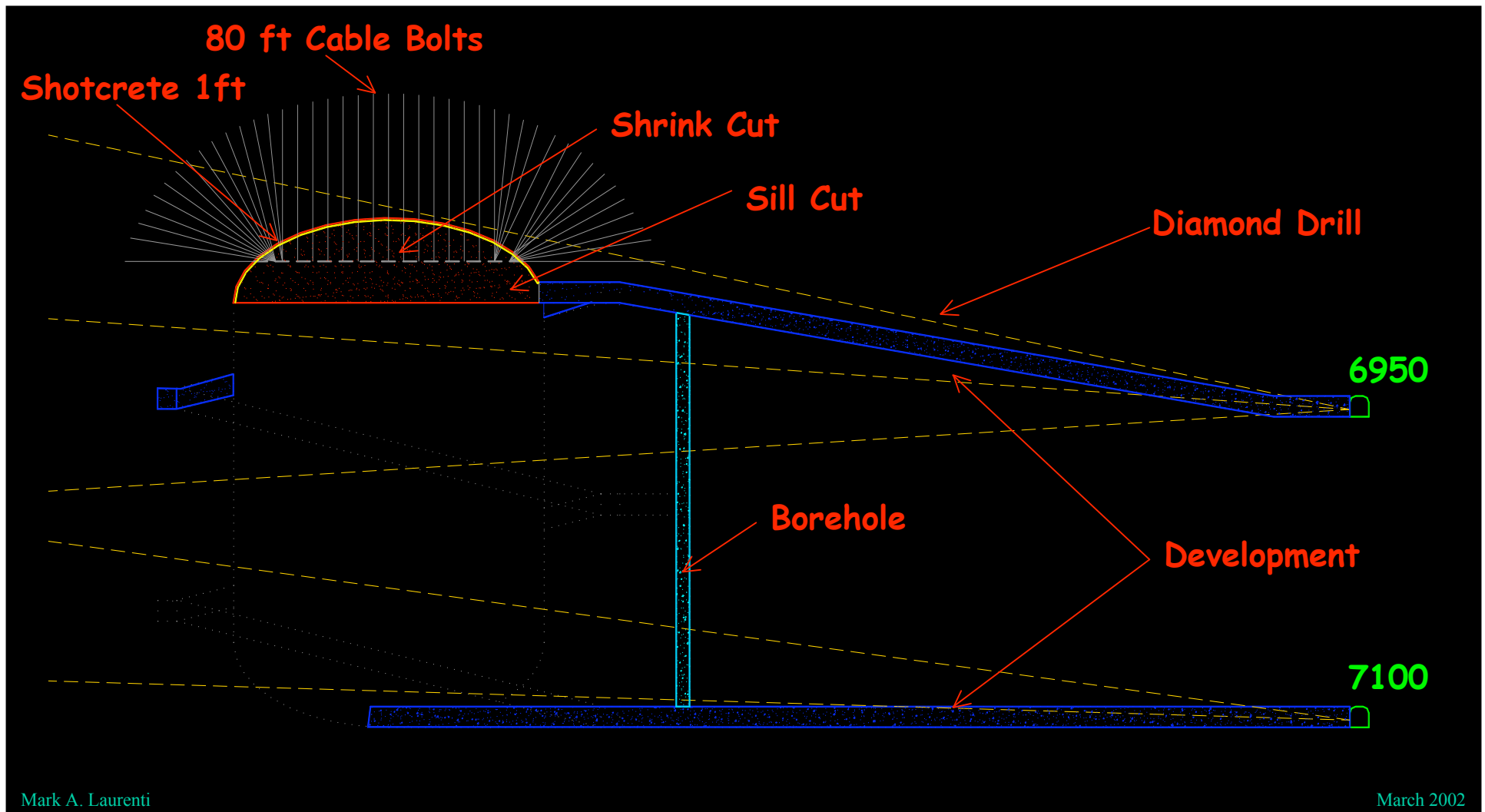


# RECOMMENDED ROOF SUPPORT – GRIMSTAD AND BARTON

- “SYSTEMATIC” BOLTING
- 5-mm SHOTCRETE

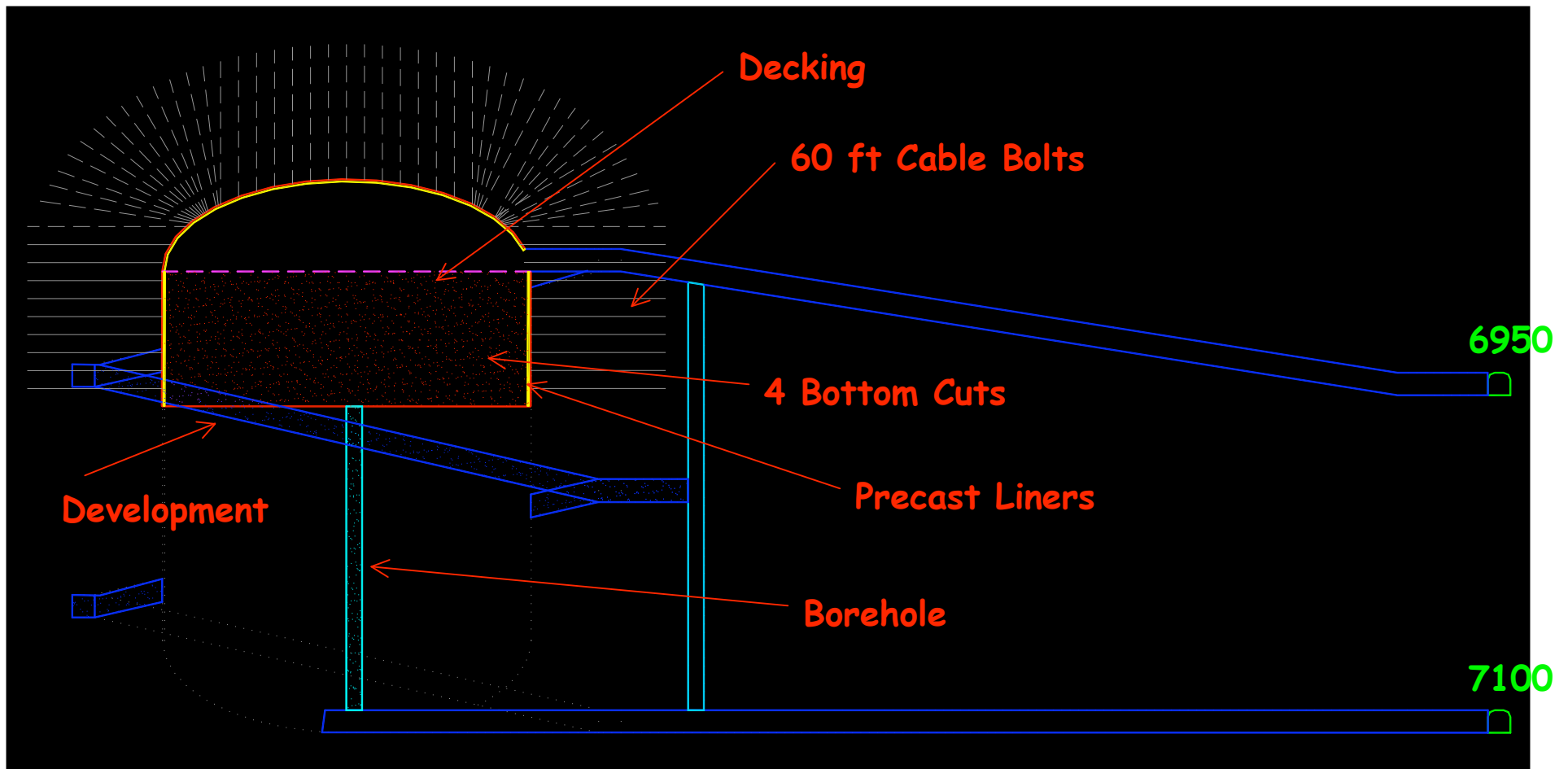
- NO “SHOWSTOPPERS”
- A COMPREHENSIVE ROCK MECHANICS STUDY IS MERITED
  - GEOLGICAL INVESTIGATION
  - ANISOTROPIC MODELING ?
  - IN SITU STRESS MEASUREMENTS

## Year One



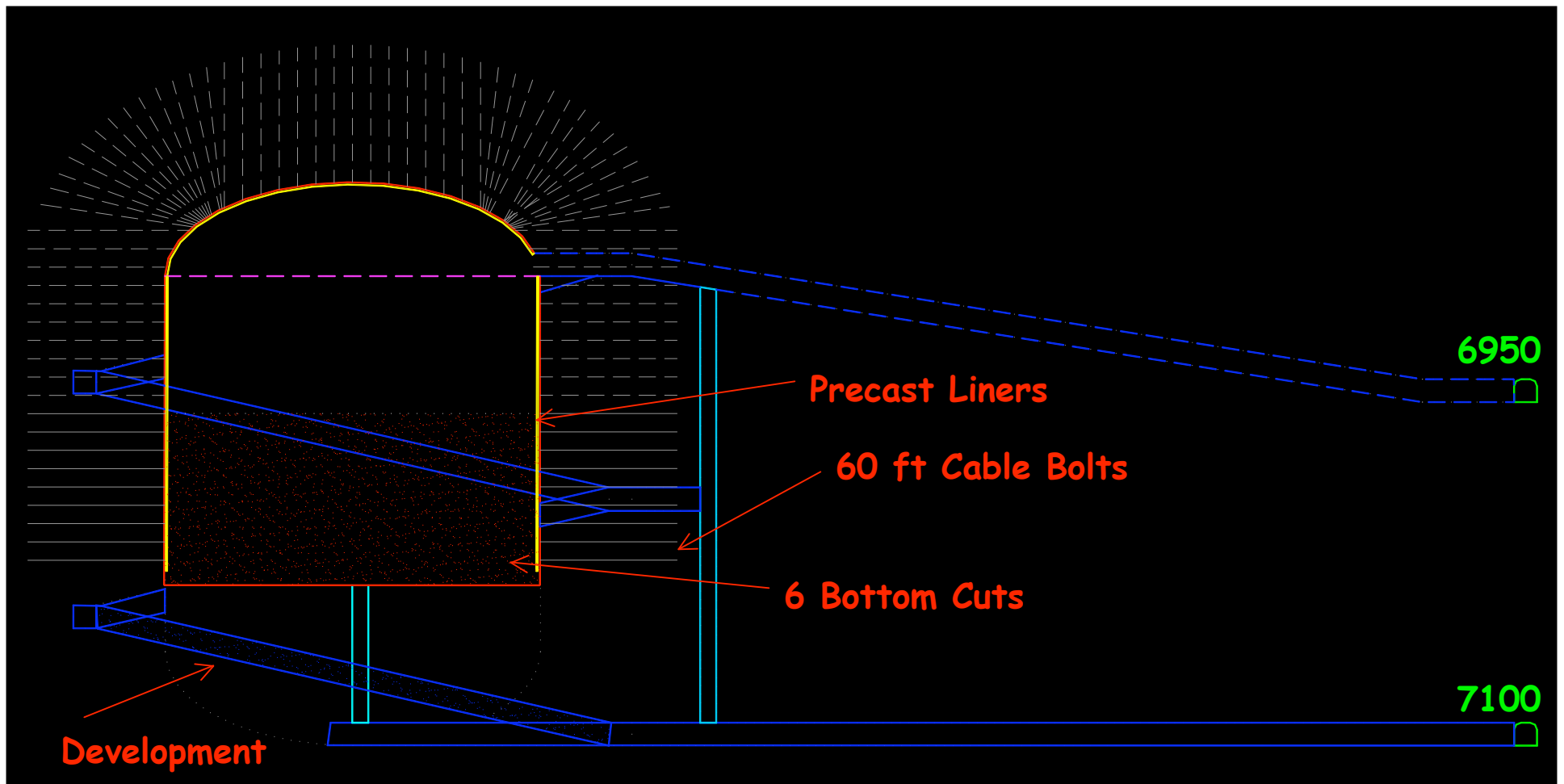
# SINGLE 100 KILOTON MODULE-HOMESTAKE

Year Two



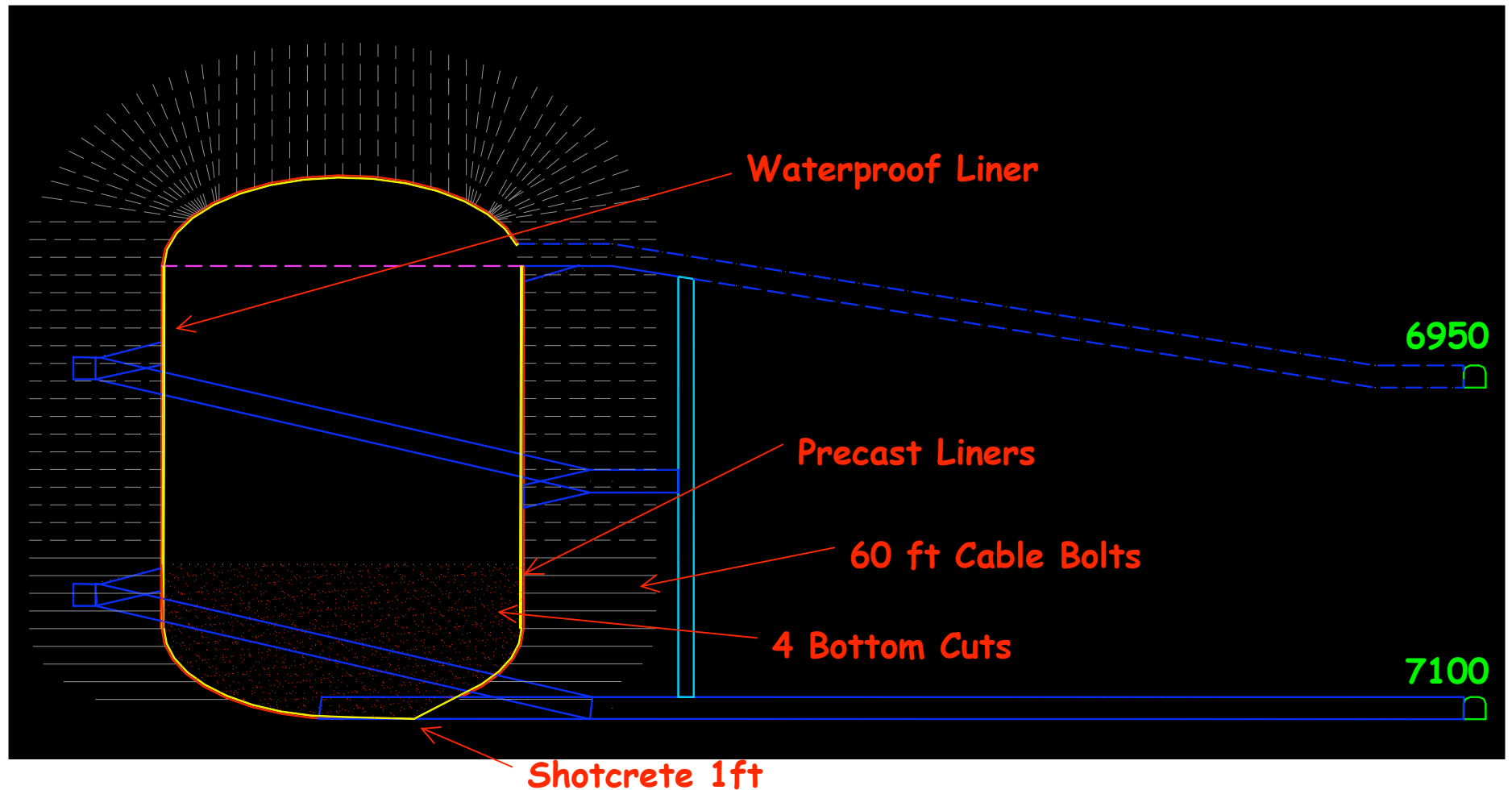
# SINGLE 100 KILOTON MODULE - HOMESTAKE

Year Three



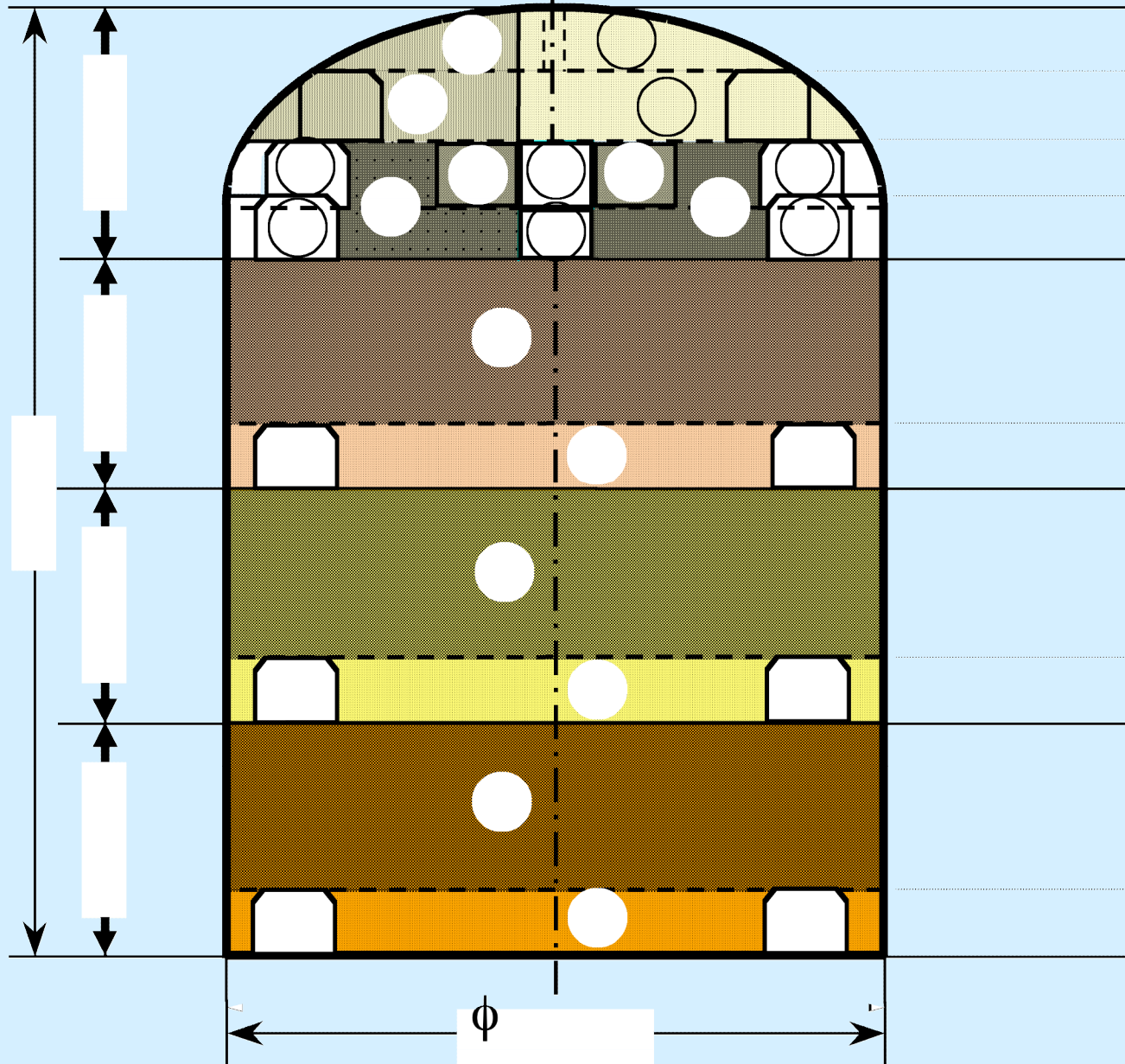
# SINGLE 100 KILOTON MODULE - HOMESTAKE

Year Four

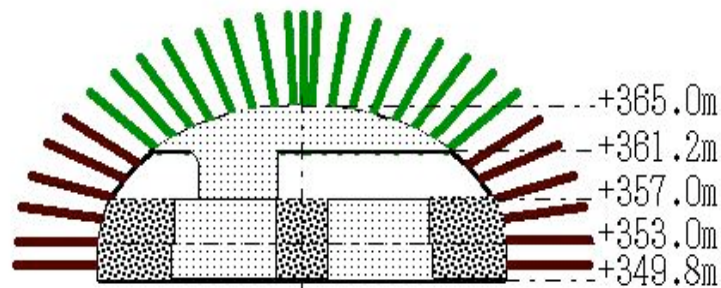


# Excavation Sequence of Super-KAMIOKANDE Cavern

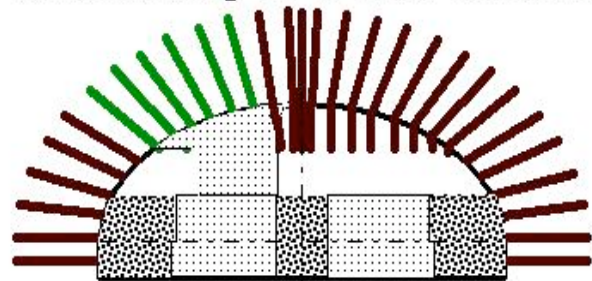
1122234891110121314 SL 365.0 mSL 335.7 mSL 321.6 mSL 349.8 mSL 307.4



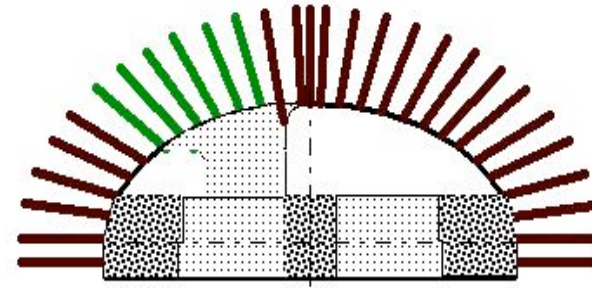
# Excavation Procedure for the Rooftop of the Cavern with Pre-Cablebolt Installation



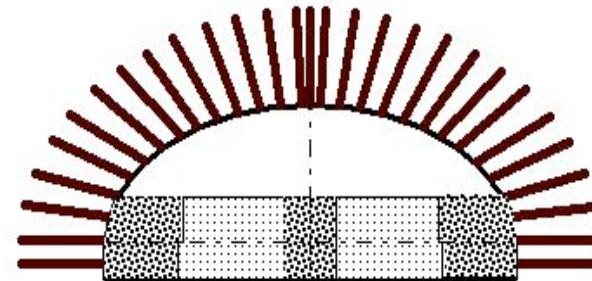
(a) Pre-cablebolting on a flat immediate roof.



(b) Upward blasting of one half of the rooftop.



(c) Shotcreting & rockbolting on the rooftop surface.

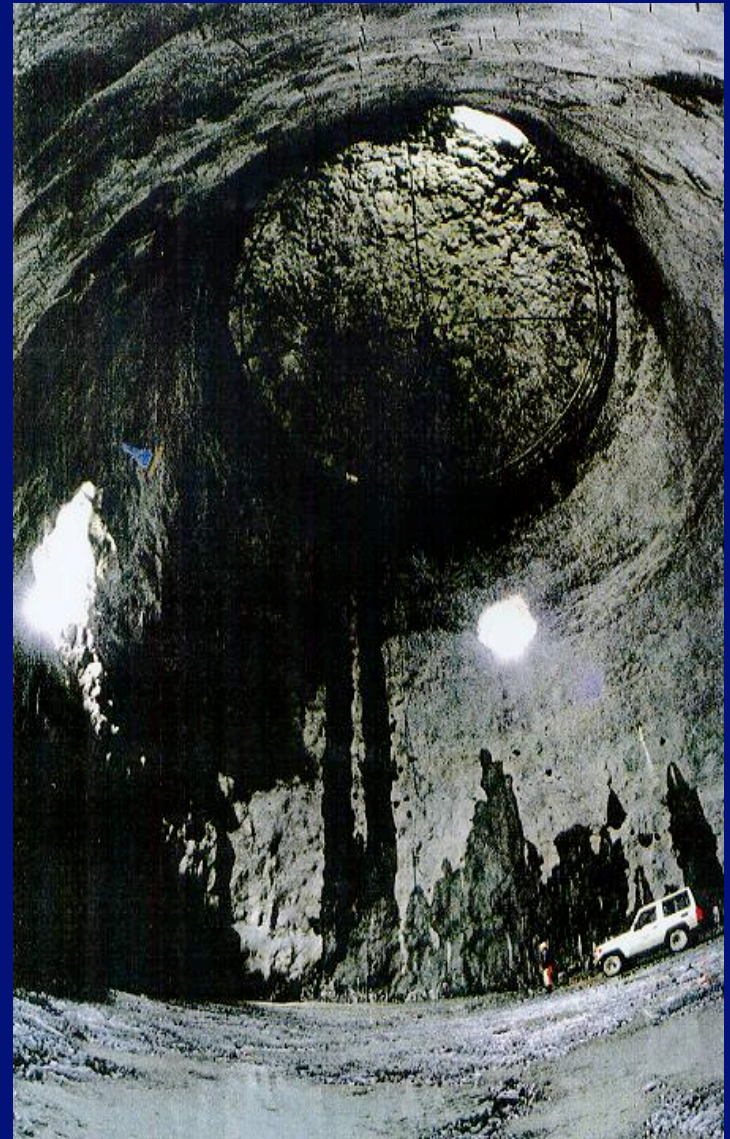


(d) Excavating the other half in the same manner.

**Long Cablebolts were Anchored Upwardly before Excavating  
1st Half Sphere of the Rooftop.  
2nd Half Sphere was Shaped in the Same Procedure.**



**Super-KAMIOKANDE**  
**Dome**  
**under Excavation**  
(since Dec. 1991 until Aug. 1994)



	One Module	Three Modules
Construction (including 30% contingency)	\$29.1M	\$66.1M
Photomultipliers and Electronics	\$62.1M	\$186.3M
Other	\$7.9M	\$7.9M
Contingency (Other + PM)	\$17.5M	\$48.6M
<b>TOTAL</b>	<b>\$116.6M</b>	<b>\$308.9M</b>

## Chamber Excavation

	One Chamber	Three Chambers
Labor & benefits	\$6.060M	\$12.030M
Mining Equipment Operation	1.430M	4.279M
Supplies	4.961M	14.685M
Precast concrete liner	3.575M	10.725M
Outside contractor	0.132M	0.396M
Plastic liner	0.250M	0.750M
Rock removal	1.000M	3.000M
Mining Equipment-Purchase	5.000M	5.000M
Contingency-30%	6.722M	15.260M
<b>TOTAL</b>	<b>29.130M</b>	<b>66.125M</b>

# Photomultipliers & Electronics

	<b>Cost for one PM</b>
28 cm dia PM tube	\$880
Installation/PM	\$165
Electronics/PM	\$120
Cable/PM	\$77
<b>Total per photomultiplier tube</b>	<b>\$1242</b>

<b>One 100 kiloton Detector</b>	<b>\$62.1M</b>
<b>Three 100 kiloton Detectors</b>	<b>186.3M</b>

## Other items

Development Labor	\$3.000M
Water Purification System* (for 10 modules)	4.500M
Calibration equipment	0.400M
<b>TOTAL</b>	<b>\$7.900M</b>

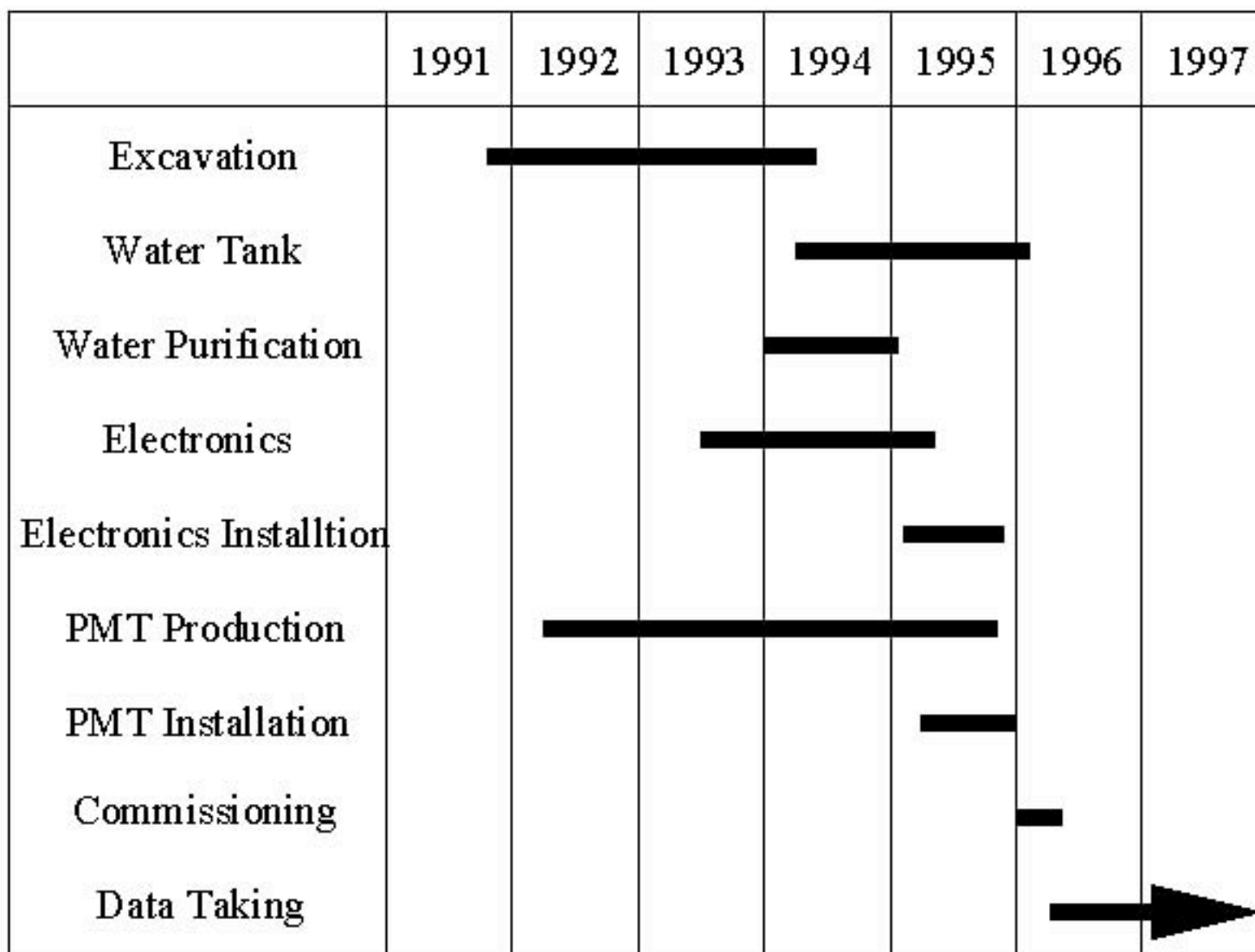
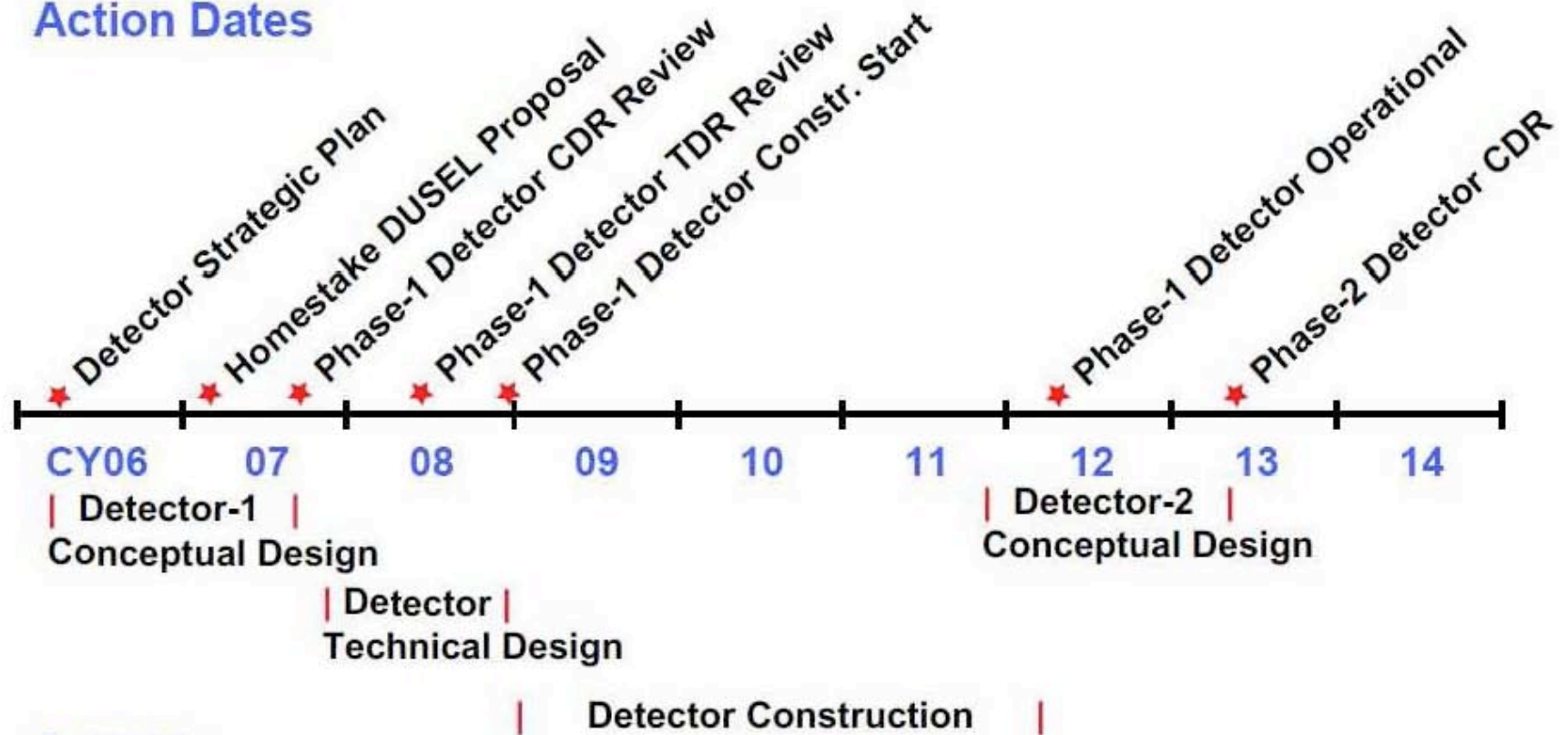


Fig. 3. Super-Kamiokande construction schedule.

## Action Dates



## Activities

# SUMMARY

- **1) Initial Detector – Three 100 kiloton modules**
- **2) Total cost - \$308M.**
- **3) Construction time – 5 years**